Section 7.3 Adding and Subtracting Rational Expressions with the Same Denominators

Adding Rational Expressions with Common Denominators:

If $\frac{P}{R}$ and $\frac{Q}{R}$ are rational expressions, then

$$\frac{P}{R}+\frac{Q}{R}=\frac{P+Q}{R}$$

To add rational expressions with the same denominators, add numerators and place the sum over the common denominator. If possible, simplify the final result. Recall that to simplify rational expressions, you should factor both numerator and denominator completely and then divide out common factors.

Example 1: Add. Express your result in simplest form.

a. $\frac{x}{x-4}+\frac{9x+7}{x-4}$

b. $\frac{4x+1}{6x+5}+\frac{8x+9}{6x+5}$

Subtracting Rational Expressions with Common Denominators:

If $\frac{P}{R}$ and $\frac{Q}{R}$ are rational expressions, then

$$\frac{P}{R}-\frac{Q}{R}=\frac{P-Q}{R}$$

To subtract rational expressions with the same denominators, subtract numerators and place the difference over the common denominator. If possible, simplify the final result. Recall that to simplify rational expressions, you should factor both numerator and denominator completely and then divide out common factors.

Note: Portions of this document are excerpted from the textbook *Introductory and Intermediate Algebra for College Students* by Robert Blitzer.

Example 2: Subtract. Express your result in simplest form.

a. $\dfrac{2x}{4x-2}-\dfrac{1}{4x-2}$

b. $\dfrac{x^3-3}{2x^4}-\dfrac{7x^3-3}{2x^4}$

Adding and Subtracting Rational Expressions with Opposite Denominators: When one denominator is the additive inverse of the other (identical expressions except for opposite signs on each term), first multiply either rational expression by $\dfrac{-1}{-1}$ to obtain a common denominator and then add or subtract as indicated.

Example 3: Add or subtract as indicated. Express your results in simplest form.

a. $\dfrac{4}{x-3}+\dfrac{2}{3-x}=\dfrac{4}{x-3}+\dfrac{-1(2)}{-1(3-x)}=\dfrac{4}{x-3}+\dfrac{-2}{x-3}=?$

b. $\dfrac{6x+5}{x-2}+\dfrac{4x}{2-x}$

c. $\dfrac{3-x}{x-7}-\dfrac{2x-5}{7-x}$

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Answers Section 7.3

Example 1:

a. $\frac{10x+7}{x-4}$

b. 2

Example 2:

a. $\frac{1}{2}$

b. $\frac{-3}{x}$ or $-\frac{3}{x}$

Example 3:

a. $\frac{2}{x-3}$

b. $\frac{2x+5}{x-2}$

c. $\frac{x-2}{x-7}$

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